Electronic Version
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Claims

[c1] What is claimed is:

1. A method of tissue suppression during gradient echo imaging comprising the steps of:
identifying a set of user-selected imaging parameters for a prescribed MR data acquisition of a targeted tissue;
setting a length of a train of alpha pulses of a gradient echo sequence specific to the user-related imaging parameters; and
applying the gradient echo sequence to selectively acquire data acquisition from the targeted tissue.
2. The method of claim 1 wherein the step of determining the length of a train of alpha pulses is carried out on-the-fly.

[c2] 3. T he method of claim 1 wherein the step of determining the length of a train of alpha pulses includes the step of determining an optimal number of RF pulses to be carried out after a spectrally selective inversion pulse.

[c3] 4. The method of claim 3 wherein the spectrally selective inversion pulse is constructed to have a flip angle sufficient to drive longitudinal magnetization of the suppressed tissue into a steady state condition prior to ap-

plication of a subsequent alpha pulse.

[c4] 5. The method of claim 4 further comprising the step of applying another spectrally selective inversion pulse at TR, wherein the another spectrally selective inversion pulse has a flip angle of 180°.

[c5] 6. The method of claim 3 wherein the step of applying includes applying the series of tissue suppression pulses immediately after the spectrally selective RF pulse.

[c6] 7. The method of claim 1 further comprising the step of placing, at a center of k-space, data corresponding to a gradient echo substantially corresponding to a null point of the suppressed tissue.

[c7] 8. An MRI apparatus to acquire gradient echo data comprising:

a magnetic resonance imaging (MRI) system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images; and

a computer programmed to:

(A) determine a null point of tissue to be suppressed;

(B) determine a time interval for longitudinal magnetiza-

tion of the tissue to recover to the null point; and
(C) from the time interval, determine a number of alpha pulses to be applied after each inversion pulse of a gradient echo pulse sequence.

[c8] 9. The MRI apparatus of claim 8 wherein the computer is further programmed to place at a center of k-space an echo substantially corresponding to the null point of the suppressed tissue.

[c9] 10. The MRI apparatus of claim 8 wherein a first inversion pulse has a flip angle less than 180° and subsequent inversion pulses have a flip angle of 180°.

[c10] 11. The MRI apparatus of claim 10 wherein the computer is further programmed to:
determine an arccosine of a ratio between steady-state magnetization and thermal equilibrium magnetization; and
set the flip angle of the first inversion pulse to the arccosine.

[c11] 12. The MRI apparatus of claim 8 wherein the computer is further programmed to apply one of a 2D gradient echo acquisition and a 3D gradient echo acquisition.

[c12] 13. The MRI apparatus of claim 8 wherein the computer is further programmed to carry out acts (A) - (C) on-

the-fly.

[c13] 14. The MRI apparatus of claim 13 wherein the computer is further programmed to identify a set of user inputs identifying receiver bandwidth, x-resolution, TR, T_1 of the tissue, flip angle, y-resolution, and number of slices.

[c14] 15. A pulse sequence for gradient echo acquisition, the pulse sequence comprising:
a first TR period and at least a second TR period;
a first inversion pulse having a flip angle less than 180° played out during the first TR period;
a second inversion pulse having a flip angle of 180° played out during each subsequent TR period; and
a number of RF alpha pulses played out during each TR period wherein a portion of the alpha pulses is played out prior to zeroing of longitudinal magnetization of a tissue targeted for evaluation.

[c15] 16. The pulse sequence of claim 15 wherein the flip angle of the first inversion pulse is set to a value sufficient to immediately drive suppressed transverse magnetization of the tissue to steady-state.

[c16] 17. A computer readable storage medium having a computer program to implement a gradient echo acquisition and representing a set of instructions that when exe-

cuted by a computer causes the computer to:

identify a set of user-selected imaging parameters for an imminent MR scan of a targeted tissue;

on-the-fly, determine a flip angle of a spectrally selective inversion pulse to be applied to immediately drive suppressed magnetization of the targeted tissue to steady-state; and

on-the-fly, determine a number of alpha pulses to be applied after the spectrally selective inversion pulse such that alpha pulses are applied before and after longitudinal magnetization of the targeted tissue reaches zero.

[c17] 18. The computer readable storage medium of claim 17 wherein the set of instructions further causes the computer to reset the flip angle of the spectrally selective inversion pulse to 180° after expiration of a first TR period.

[c18] 19. The computer readable storage medium of claim 17 wherein the set of instructions further causes the computer to fill k-space such that an echo substantially corresponding to a null point of the targeted tissue fills a center of k-space.

[c19] 20. The computer readable storage medium of claim 17, wherein the set of instructions further causes the computer to place, at a center of k-space, data corresponding to a gradient echo substantially corresponding to a

null point of the suppressed tissue.